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EDITORIAL

THOUGHTS ON THE BRITISH VETERINARY CODEX

THE publication of a British Veterinary Codex emphasizes the great part which the dispensing of medicinal preparations and substances plays in the life of a practicing veterinary surgeon.

A sound knowledge of the art and craft of the Pharmacy is not so essential to the human physician for he can rely on the Pharmaceutist to supply his wants and even to correct his errors.

The education of a veterinary student is in many ways very similar to that of his friend who attends a medical school. In both instances the study of certain basic sciences serves as a preliminary to the vocational or clinical studies. It is in this later period that a divergence in outlook and in method or application becomes most apparent. The patient in one instance is a fellow human being capable of independent thought and considered retort and this calls for a psychical approach governed by sentiment and compassion and in which economic factors are not of prime importance.

In the other instance the work is most certainly flavoured by sentiment and impregnated with a deep humanity but on the majority of occasions it has to conform to the exacting tenets of finance and maybe to the legal code.

The owner of an animal is not compelled to give or provide succour for his beast until death rings down the curtain.

(The February issue of "The British Veterinary Journal" was published on February 18.)

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Whilst the animal is alive the law demands that it shall be given reasonable care and attention but if treatment be uneconomic, speculative or in any way difficult then the owner can solve his dilemma by resorting to destruction.

Academic brilliance and technical skill are not the only attributes of a competent and successful veterinary surgeon. He must be a man of astute judgment, able to sum up a situation and in his prognostications he must consider the financial implications as they may affect his client. The death of an animal may be the least of the client's troubles.

The man who is inherently of a scientific bent and who would like to study the progress of a disease to the ultimate end may feel frustrated when he has to orientate his ideas to such exacting economic conditions. On the other hand hard factual standards serve as a spur to the majority of those who practice in the field and no doubt many animal patients, if they could speak, would express their gratitude to the man who would release them from a welter of suffering.

Amongst the most powerful aids of the veterinary surgeon in his fight against disease, pain, and suffering is his knowledge of the actions and uses of medicinal agents and his skill in the Pharmacy.

The former may make a successful issue more certain, the latter can make all the difference between personal economic solvency or insolvency.

The British Veterinary Codex comes at an opportune time. New agents are thrust upon us in almost daily routine, some of them have a therapeutic effect little better than the old friends that have served so well in the past, and the increased cost is not always proportionate to their effectiveness. There is a great danger that we may become a race of "Blotter prescribers." The Codex reviews them all and the practitioner, the client and above all the patient may profit if its pages be perused.

GENERAL ARTICLES

RADIOLOGICAL STUDIES ON THE GASTRO-INTESTINAL TRACT OF THE DOG

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PART I.

Introduction

That the topography of the abdomen as it is seen in the dissection room bears little relationship to the disposition of the viscera in the living subject is appreciated by the clinician: laparotomies and the examination of clinical radiographs very soon dispel the impression of a neat stereotyped arrangement of the viscera which has been acquired from the study of anatomy. This is very apt to arouse doubts in the mind of the clinician as to the relevance of anatomy for experience teaches that he is very often unable to apply the knowledge acquired in the dissection room to his diagnostic and surgical needs and he is well aware that a blind adherence to the textbook teaching will frequently involve him in serious difficulties and jeopardise the success of his interventions. In human surgery, operation by textbook anatomy was the rule from the time of the first introduction of abdominal operations and given fresh impetus when the new technique of radiology enabled the surgeon to see the position of the organs in his patient and confirm that they did not correspond to the illustrations in the textbook and to his memories of the dissection room. The opening of the X-ray era was marked by a spate of abdominal operations whose object was to correct imagined displacements and malformations of the abdominal viscera—it was the day of the "dropped stomach" and the "redundant colon." What in fact was being undertaken was the tailoring of the living organs to conform with the appearance of the viscera in the embalmed cadaver and it was not surprising that these operations were seldom attended by the success that was anticipated. When it was discovered that these so called defects were exceedingly common and were as frequently found in people who complained of no illness, the idea began to gain ground that it was not the viscera but the textbooks that were at fault. The radiologists, who in their efforts to develop their subject had begun to make surveys of normal people were the first to appreciate the true position but their criticism was not at first held to be valid by the surgeons and the anatomists and they agitated in vain. In time, however, the logic of the radiologists was admitted and the movement towards the rational study of the abdomen gained momentum. The outstanding contribution to this crusade was made by Barclay who developed very clearly the conception of Fluid Anatomy and showed that the abdomen could only be studied in the living and that the definition of the normal must be extended to include much that was previously considered to be abnormal. His writings and teaching exerted a profound influence on the surgery of the time and a more enlightened

and rational approach to abdominal surgery came into vogue as a consequence of his efforts. The surgeon became less dogmatic—murder *secundem artem* was going out of fashion.

The reaction of the anatomists to this new teaching was at first hostile but later as evidence accumulated they were won over and recognised that while the dissection room provided an adequate basis for general anatomical instruction, visceral anatomy could only be studied in the living. As a result of this teaching the human anatomists recognised that the viscera are subject to changes in position, form and relationship, and that even those organs that appear relatively fixed, such as the pancreas, may undergo considerable alteration in position. These alterations are produced partly by intrinsic movements and activity, partly by the activity of neighbouring and even distant organs and also by changes in the posture of the patient. In view of this it is manifestly impossible to separate the study of the living anatomy of these organs from their physiology and, while it is permissible to concentrate on one of these aspects it is always to be borne in mind that physiological function exerts a profound influence on the shape and arrangement of the viscera.

In animal practice the abdominal cavity has not been studied as extensively by radiography as in medicine, and as a result the shortcomings of our anatomical teaching have not been made so obvious, for while individual practitioners have discovered the discrepancies between their observations and the textbooks, veterinary opinion has not been able to benefit from anything in the nature of the wide experience which has been afforded to the medical practitioners by their extensive use of radiology. In the absence of this stimulus the veterinary anatomist has neglected to re-orientate his teaching in the light of radiological information and compare the conditions observed in life with those familiar in the cadaver.

The purpose of these notes is to make a contribution to our knowledge of the radiological anatomy of the dog, and while this has been undertaken primarily in the interests of anatomy, it is hoped that it will provide information of the appearance of normal organs that may help the clinician in his interpretation of radiographs of the abnormal abdomen. Up to the present radiology of the gastro-intestinal tract has not played an important part in small animal practice and its role has been largely confined to the demonstration of such major abdominal catastrophes as intussusseption, diaphragmatic hernia or the presence of foreign bodies. There is however, the possibility that there will be a more extensive recourse to radiography, not only in cases such as those just mentioned but in more obscure conditions demanding the use of contrast techniques, and the interpretation of plates of these conditions, in particular, may present many problems to those unfamiliar with the radiological appearance of the normal.

Material and Methods

A general survey of the gastro-intestinal tract may be carried out without elaborate techniques and useful information on the topography of the tract may be obtained by the study of the course and fate of a single barium meal—the detailed investigation of individual organs however requires special prepara-

PLATE I

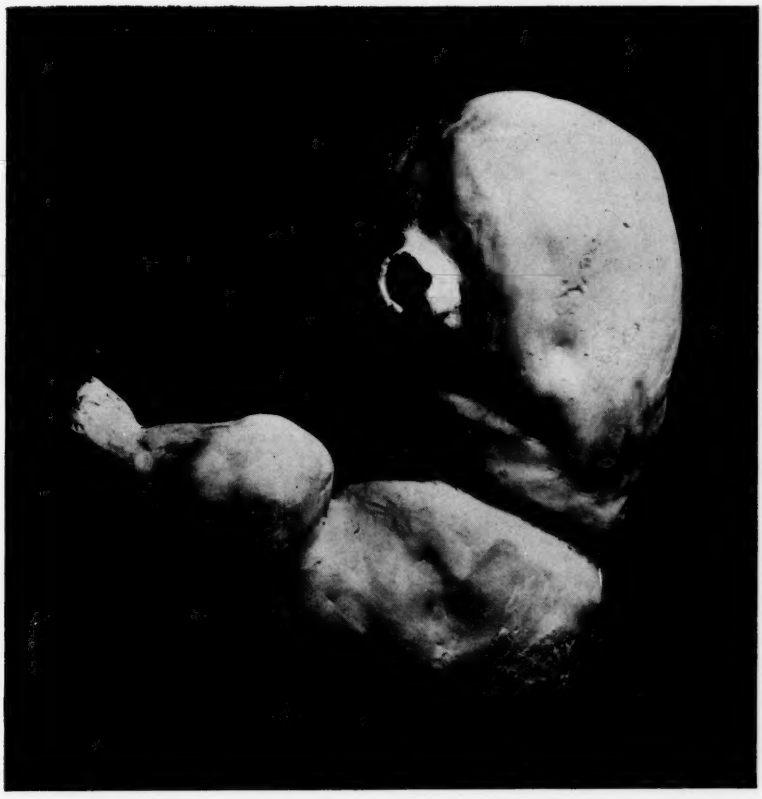

Fig. 1

Plaster model of stomach constructed from radiographs (viewed from in front and slightly from the right).

(*Article by Dyce and Merlen, page* 83)

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PLATE II

Fig. 2

Fig. 3

Fig. 4

Fig. 2
Left lateral view* indicating a vertical position of the stomach with the pyloric part concealed and little indication of the separation of the parts of the organ. It should be noted in this plate that the most dorsal part of the stomach appears to lie within the thorax and this serves to emphasise the importance of bearing projection effects in mind. The presence of the magenblase will be noted in the fundic region.

Fig. 3
A similar projection showing an anterior inclination of the long axis and differentiation of the pars pylorica.

Fig. 4
In this plate the sinus and antrum are distinct due to the decreased rotation of the long axis of the organ. The fundus is more globular.

* The terms employed to designate the positions indicate the part of the animal in contact with the plate, e.g., a left lateral view implies that the left side of the animal is in contact with the cassette.

(*Article by Dyce and Merlen, page* 83)

PLATE III

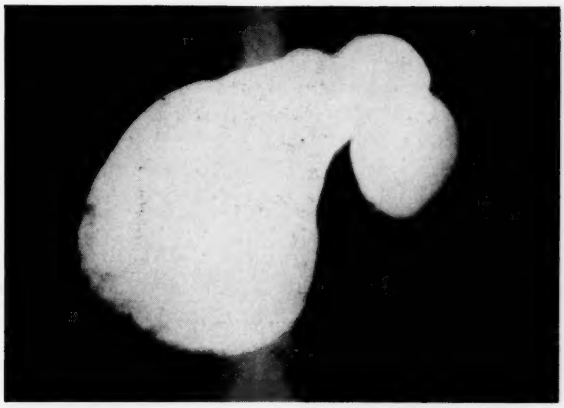

Fig. 5

Ventral view. A marked anterior inclination of the long axis of the stomach with the parts distinct and the pylorus fairly lateral in position.

Fig. 6

Postero-ventral view. Shows the first part of the duodenum.

(*Article by Dyce and Merlen, page* 83)

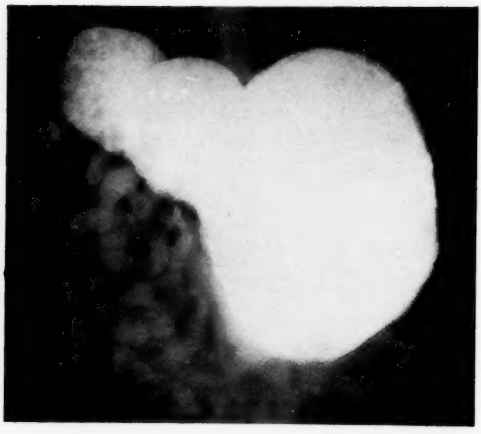

Fig. 7

Postero-ventral view. "Masons" hammer stomach.
(This plate has been reversed in printing.)

Fig. 8

Right postero-lateral view. This projection was used to disclose the concealed pyloric part.

(*Article by Dyce and Merlen, page* 83)

tion and it will be necessary to employ particular techniques which will be described in the appropriate places. As has been already noted the disposition of the gastro-intestinal tract is affected by a number of factors, most of which we are not able to control. In this preliminary study we were anxious to eliminate as many of these factors as possible in order to establish a basis for wider comparisons and we therefore employed in our work dogs of a single breed which had been brought up by a uniform method—greyhounds of both sexes were readily available and we made use of them exclusively: and as these animals had been culled from the track on account of locomotor injury they were in other respects normal. While under our care they were fed once a day and were not brought in for examination until twenty hours had elapsed since they were last fed, by which time they were hungry and on most occasions took the test meal of their own accord. If the dog was unwilling to take the meal we preferred to cancel the experiment rather than to force feed it and risk complicating the results by introducing factors resulting from emotional upset. The nature and quantity of the meal was obviously varied according to the work in hand but usually consisted of a simple suspension of pure barium sulphate in water, lightly flavoured with a meat extract.

Bearing in mind that the viscera will vary in shape and position with the attitude of the animal we adopted a standing position as our standard as this is not only the most usual, but involves least restraint and therefore occasions the minimum of distress to the animal; moreover it is convenient for the purpose of radiology, although it does not permit complete examination of all the organs for which other positions are necessary.

Allowance must constantly be made for distortion effects in the radiographs due to the divergent nature of the X-ray beam, and these effects are at their greatest when the organ is some distance from the film and of large size: for, if this consideration is ignored, it is possible to obtain radiographs in which the stomach appears to be in the thorax or superimposed upon the colon. It is necessary therefore to examine the organs one at a time and to ensure that the beam is accurately centred over the precise area under investigation, to minimise these projection effects, although it will not of course eliminate them.

We cannot conclude this note on technique without referring once again to the vital necessity of ruling out as far as possible the effects of psychological disturbance. As is well known, emotional factors exert the most profound influence on the viscera and their topography, and unless steps are taken to ensure that the animal comes for examination calm and unafraid, the resulting radiographs may well show the viscera in an abnormal state.

The Stomach

The stomach of the dog has been the subject of a number of radiological studies during the past twenty years: many of these investigations have been purely physiological in nature and need not concern us here. Among the remainder, two works entirely devoted to the stomach require particular mention—that of Coulenson and above all the monumental but little read paper of Carlin.

The textbooks of veterinary radiology—Kirk, Schnelle, Henkels and Visnyakov give very little information on our subject. Carlin's work is in addition, of value in that it examines much of the early literature on this subject and a further review of the previous literature is unnecessary although a later paper of Zietschmann's should perhaps be mentioned. While Carlin's technique may be criticised in that he used forced feeding, his monograph is so complete that the following notes on the anatomy of the stomach contain little new information and are mainly given for completeness, and because the original work is often difficult to obtain.

It will be remembered that the carnivore's stomach is usually empty and then has an entirely different shape from the organ when full. The state of the organ should therefore be indicated at the outset of an anatomical description. According to the traditional accounts the full stomach is pyriform in shape, having a large, globular cardiac extremity and a contracted and tubular pyloric part. The empty organ is said to be more uniform in calibre with the cardiac enlargement almost obliterated.

Radiologically it is difficult to demonstrate the empty stomach and the most that can be achieved at this stage is a picture of the outline of the mucosa to which particles of barium still adhere after the bulk of the meal has passed on. It is more convenient therefore to take as a standard a stomach moderately distended with food, not only because in this state the organ is readily shown on X-ray but because the separate parts can readily be identified. In naming the parts of the stomach we have followed the lead of Carlin who bases his terminology on that in use in human radiology. Examination of the plates will show that the form of the stomach varies considerably from the organ as seen in the dissection room, upon which the textbook illustration has been founded time-out-of-mind : in life the stomach with the globular sac and tubular appendage does not exist and in its place we find an organ characterised by a bold rounded fundus, a full corpus, a distinctly separable sinus and an antrum in the pyloric part. As has been indicated above there is no stereotyped form of normal stomach and an infinite variety of variations may be observed in the healthy animal—in some cases it may be possible to separate the parts from each other and the stomach may appear as a simple sac.

Broadly speaking the stomach lies in the left anterior part of the abdomen and immediately behind the diaphragm where it is covered by the ribs but the exact site of the organ is subject to considerable variation—the axis, which lies close behind the diaphragm, may extend cranially, caudally or vertically and the organ being twisted on its long axis with the lower part rotated towards the right, the cardiac and pyloric extremities are sometimes almost at right angles to each other and at other times culie more or less in the same plane. This rotation involves chiefly the lesser curvature joining entrance to exit and it is this to which the name *magenstrasse* is given, implying that a gutter-like communication exists here between the two extremities. On a lateral view the pyloric part of the stomach is frequently observed to lie cranial to the corpus and there is usually a considerable degree

of overlapping of the projections of the two portions: as a result it is only exceptionally that a normal lateral projection permits the identification of the major divisions of the organs. The exact position of the stomach is further influenced of course, by the degree of distension, for when full to capacity it will project beyond the costal cartilages, reach the floor of the abdomen and even extend far back towards the pelvis. A ventral view shows that the stomach is disposed across the vertebral column with the pylorus either immediately beneath the spine or extending on to the right side. These positions are indicated clearly in the accompanying radiographs. In view of the conception of fluid anatomy it is manifestly nonsense to define the shape and position of the stomach more rigidly and in greater detail since to do so is to return to the classical method of description with its inherent errors and shortcomings.

It will be noticed that the stomach invariably contains an air bubble or *magenblase* of varying size and that in the normal standing position this occupies the fundus: in other postures naturally occupies the uppermost part of the organ.

The processes of filling and emptying of the stomach together with its movements will be considered in a later paper when the passage of the meal through the tract is discussed.

Acknowledgments

We wish to thank Professor McCunn for the interest he has taken in this work. We are indebted to Mr. George Smith for providing us with dogs, to Messrs. Bryant, Crosby & Levy for their technical assistance and to Mr. Burgess of the Histology Division for the photograph reproduced as figure 1.

STUDIES IN BOVINE MALIGNANT CATARRH

IV. Immunity and Vaccination

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INFORMATION about the quality and duration of immunity after recovering from bovine malignant catarrh is hard to obtain because the "head and eye" form of the disease, the characteristic type found in East Africa, is highly fatal and recoveries are rare. Nevertheless, evidence accumulated during the past thirty years indicates that recovered animals, when not in contact with the disease, have an immunity of short duration only. On the other hand, where the disease is enzootic older animals appear to be relatively resistant. At the Ngong Veterinary Training Centre, where malignant catarrh was once enzootic (Piercy, 1952*a*), it was noticeable that most cases occurred in weaner stock and it must be assumed that the resistance of older animals was maintained by virtue of the continual presence of virus.

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As Henning (1949) points out, " The Immunity reported by Mettam (1924) in the few animals that recovered is so poor that attempts to evolve a satisfactory method of artificial immunisation are unlikely to succeed. . . . The most rational form of prophylaxis, therefore, is to assure that cattle do not cohabitate or directly mix, in any form, with either wildebeeste or sheep." The same author, however, writes: " On the other hand, the fact that outbreaks of malignant catarrh or ' snotsiekte ' have been reported in areas where there has been contact neither with sheep nor with wildebeeste (Wysemann, 1934, 1937; Daubney and Hudson, 1936; du Toit and Alexander, 1938) shows that there are other carriers or factors that have not yet been traced."

In Kenya, severe losses from malignant catarrh continue to occur in some areas, particularly in Masai-land. Moreover, the value of much of the European-owned stock has reached a very high level and when an incurable disease such as malignant catarrh makes its appearance amongst such animals serious economic losses are sustained.

Although the prospect of elaborating a satisfactory method of artificial immunisation is not encouraging, any comprehensive experimental examination of the disease would be incomplete without attempts to acquire an understanding of resistance and immunity that might point the way to prophylactic measures.

Experimental

The techniques, materials and type of animals used were similar to those already described in previous articles of this series (Piercy, 1952*a*, 1952*b*, 1953*a*).

(1) *Acquired Immunity following natural infection.*

In July, 1950, a Friesian cow in the advanced stages of the disease was brought to the laboratory. It exhibited the classical clinical symptoms of the " head and eye " form of malignant catarrh. Contrary to expectation this animal recovered after a protracted illness and regained normal health apart from a slight residual opacity of the left eye. On October 16, ten weeks later, it was challenged with virus (" D ") obtained from the same outbreak and passaged with fatal results through four generations of animals at the laboratory. The animal was immune and no reaction occurred.

Later challenges carried out at intervals of five, three and five months respectively were successfully resisted. It is of interest to note, that a brief temperature rise of 48 hours' duration occurred two months after the second challenge inoculation, and a more irregular but prolonged one commenced 19 days after the fourth challenge. It is not known whether these two mild temperature rises represented reactions to the challenge inoculations; if they did, it would follow that the animal's immunity at these times was on the decline and that the absence of temperature elevations at other times indicated solid immunity. On this basis, immunity was ebbing eight months after recovery from natural infection, and again eight months after reinforcement by the second challenge.

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Two other comments on this animal's history can be made. Firstly, that each successive challenge reinforced existing immunity whether or not a temperature reaction occurred although evidence will be presented later to suggest that this was not so. Secondly, that the absence of any obvious reactions to challenge, other than brief temperature elevations of dubious significance, indicated that the animal had gained a solid immunity lasting from July, 1950, when it first contracted malignant catarrh, to November 1, 1951, when it was last challenged, a period of 16 months.

In June, 1951, an extensive outbreak of malignant catarrh occurred amongst two herds of Boran and high-grade Ayrshire cattle on a farm in the Kitale district and during one period of six weeks 50 deaths occurred. It is of passing interest that the only step taken to control the disease, other than the application of normal hygienic measures, was to remove a flock of Karakul sheep which were in contact with the cattle. Two and a half months later, fresh cases ceased to occur.

A number of affected animals survived and one of them, a six-year old grade cow whose calf had also contracted the disease and died, was received at the laboratory in November, 1951, four months after recovery. Four days later a liver biopsy was performed and 300 ml. of blood were also collected in citrate solution. The same day 0.5 g. of the liver, emulsified in nutrient broth, was given by intraglandular inoculation to animal 2554, and the 300 ml. of citrated blood were given intravenously to animal 2555.

The recovered cow was then challenged with the "D" strain of virus obtained from another outbreak (Piercy, 1952*a*). It reacted 32 days later and died of malagnant catarrh. Hence, either the animal's immunity had disappeared or the challenge virus differed sufficiently in antigenic composition to break down existing immunity.

Meanwhile, of the two beasts which had received subinoculations, animal 2554 (liver) showed an unexplained temperature reaction after one week and thereafter remained normal. It was challenged with homologous virus ("Z"), obtained from another reacting animal (2654) of this series (see later), and remained healthy. It was then challenged with "D" virus, reacted and died.

The second animatl (2555), which received citrated blood, started, 19 days after inoculation, a temperature reaction which reached a peak of 105.6° C., and extended over a period of 7 days. During this time the animal appeared to be slightly "off-colour"; there was a watery discharge from the right eye, and the superficial lymph glands were noticeably enlarged. Blood and gland smears showed no parasites. By December 17, four weeks after inoculation, normal health was regained. On the fifth day of the temperature reaction, immediately after the febrile peak, 500 ml. of blood were obtained in citrate solution. This animal was also challenged with homologous virus ("Z") and remained healthy. Two months later, when given "D" virus, it reacted and died.

Using the citrated blood collected from the above animal (2555), animals 2653 and 2654 were given 200 ml. and 250 ml. respectively by the intravenous route. The former did not react and, when challenged later with "D" virus, it proved to be susceptible. The latter started a temperature rise after 18 days

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and was destroyed *in extremis* a week later. No symptoms characteristic of malignant catarrh were seen before death and the examination post-mortem was equally unrevealing. There was inflammation of the turbinate mucous membranes, a fairly acute hyperplasia of the mucosa of the abomasum, an enlarged liver, congested kidneys and slight inflammation of the lining of the bladder. Histological examination of the liver, brain and adrenal gland showed no evidence of the changes commonly associated with malagnant catarrh (Plowright, 1953).

Using lymph gland collected at death, subinoculations from the above animal (2654) were made to two susceptible steers (2158 and 2157), and two other animals (771 and 1224) which had recovered from experimental infection with the "D" strain of virus. Of the two susceptible animals, one did not react and the other had a fluctuating temperature rise during the seventh week after inoculation and then returned to normal. When challenged with "D" virus they reacted and died. Neither of the two animals immune to the "D" strain of virus reacted.

Although it is difficult to interpret these results, two generalisations may be made. Either an unidentified disease, similar to malagnant catarrh, was transmitted from the original recovered cow through two further generations of cattle before it died out, or it was a malignant catarrh virus that produced the reactions described. If the latter supposition be correct, then virus was obtained from an animal that had recovered four months previously. This would suggest an entirely new concept of transmission in that if a recovered animal harboured virus for long periods it might prove a source of infection to other cattle, via an insect vector for example, without the necessity for intermediate hosts such as sheep or wildebeest. Furthermore, the fact that the recovered cow was susceptible to challenge with the "D" virus shows that the virus recovered was of antigenic dissimilarity.

(2) *Some experiments with formalised vaccines.*

Animal 9153, experimentally infected with "D" strain virus, was destroyed *in extremis* after a typical reaction lasting five days. A prescapular lymph gland was removed, stored overnight at —20° C., and then passed through a mincing machine, half its volume of 9/N saline being added afterwards to disrupt the cells. After 24 hours storage at —4° C., $4\frac{1}{2}$ volumes of distilled water were added to bring the salt concentration to normal, the mixture shaken for one hour, passed through fine muslin, and formalin added to a concentration of 0.5 per cent. The vaccine was stored again for three days at —4° C.

Three animals were each given 10.0 ml. of vaccine by subcutaneous injection. Animal 623, challenged after 25 days, reacted and died of malignant catarrh. Animal 221, challenged after two months, did not react. Animal 122, challenged after four and a quarter months, commenced a prolonged and intermittent reaction after 26 days. For the next ten days it showed only a slight nasal discharge with no definite temperature rise. From the 38th day an intermittent temperature reaction started with lachrymation and nervous

twitchings of the eyelids. The animal died 62 days after the challenge inoculation had been given and the examination post-mortem revealed typical lesions of malignant catarrh.

This result seemed to offer sufficient encouragement for further trial and accordingly a gland was obtained from animal 621, reacting to experimentally induced malignant catarrh, and treated in the same way as before except that, after the mixture had been shaken for one hour, it was allowed to stand for a short while and the supernate decanted, the grosser particles being eliminated in this way instead of by screening through muslin.

Six animals were each given three subcutaneous inoculations of 10 ml. of vaccine at nine-day intervals. Two were challenged at seven weeks, and three at four months after vaccination. All reacted and died of malignant catarrh. One animal was not challenged.

This result was discouraging and the next attempt, therefore, was made using formalised gland mixed with equal parts of " adjuvant " consisting of mineral oil, a culture of *M. butyricum* and lanoline. Two steers (3649 and 3451), each given 2.0 ml. of the " adjuvant " vaccine, were challenged after five and eleven weeks respectively and both reacted and died within the usual period. Similar attempts to immunise rabbits with an " adjuvant " vaccine containing infective rabbit spleen failed to protect them against challenge with a lapinised strain of malignant catarrh virus (Piercy, 1954).

Field Trials

Although these results were discouraging, a few thousand doses of formalised vaccine were prepared and used in the field since it was thought that the method of challenge at the laboratory might be much more severe than exposure to natural infection. A virulent outbreak occurred on a farm near Nairobi amongst a herd of high-grade Friesian cattle. Liver, spleen and gland were obtained from an animal destroyed *in extremis,* minced together in equal parts, and prepared by the technique already described. Before vaccination, 18 deaths had occurred at the rate of 4 or 5 a week. About 300 animals, including calves, were given a course of three inoculations of 10 ml. of vaccine at weekly intervals. Seven more animals died between the first and second inoculations. Thereafter no fresh deaths occurred.

This herd was reinoculated a year later with one dose of vaccine only and, since the outbreak just described, one further case has been diagnosed over a period of two years. This particular animal, only recently purchased, had not received the original full course of three inoculations. It may be added that malignant catarrh had previously been endemic on the farm for many years.

Another opportunity to estimate the effect of vaccination arose when malignant catarrh broke out in native-owned Zebu cattle about thirty miles from Nairobi. Material from this outbreak for autogenous vaccine production could not be got and, accordingly, vaccine was made from the liver, spleen and lymph gland of an animal at the laboratory that died after experimental infection with

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the "D" virus, which had been obtained from the outbreak previously described and maintained in cattle by serial passage.

A course of three vaccinations was given as before; in this instance no beneficial effects resulted and the course of the disease remained unchanged.

(3) *Some observations on immunity.*

It has been possible to make a number of observations on the immunity acquired by vaccinated animals or by animals which resisted needle infection.

Animal 221, inoculated with formalised vaccine, showed a slight temperature rise commencing after ninteen days and lasting for three days. It was challenged two months after vaccination and proved to be immune and resisted a second challenge six weeks later. One month later it was challenged for the third time, reacted after an extended incubation period of thiry-seven days and died of malignant catarrh. This animal's immunity, therefore, remained solid for about four months and then declined.

A second vaccinated animal, No. 122, challenged after four and a quarter months, commenced a prolonged and intermittent reaction after 26 days and died 36 days later. On several occasions it seemed likely that this animal would recover. Its state of immunity may be considered as similar to that of the previous case, and declining after four months.

Animal 141 did not react to an inoculation of infective blood and survived challenges six weeks and three and a half months after inoculation although on the second occasion there was a mild reaction, characterised by a slight temperature rise during nine days starting one month after challenge, lachrymation, opacity of both eyes and inappetance. Three months later it was challenged for the third time and survived. The indications here are that this animal's immunity was waning at three and a half months when it reacted mildly to challenge, and its immunity was then sufficiently reinforced to enable it to resist a third challenge three months later.

Another animal, No. 771, also survived an inoculation of infective blood although it had a mild reaction characterised by slight lachrymation and a fluctuating temperature. It resisted challenge inoculations after two and eight months.

A Boran steer, No. 1223, given lymph-gland that had been lyophilised and stored at —20° C. for two months showed no reaction. It resisted challenge inoculations two, four and ten months later. As other work (Piercy, 1953a) has shown that virus lyophilised and stored for longer than a few days becomes completely inactivated, it can hardly be supposed that this animal gained an immunity from inoculation with such material. This case, therefore, represents one of the very rare instances of prolonged, if not permanent, natural resistance to malignant catarrh.

(4) *Survival of virus in the bovine host.*

Beveridge (1952) has advocated a method of classifying viruses according to the type of immunity produced. Three main classes are suggested.

The first includes viruses, such as rinderpest, fowl pox and distemper, which

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cause permanent immunity and are not characterised by antigenic differences between strains.

The second is composed of viruses which confer an immunity of moderate duration, for example, foot-and-mouth disease, bluetongue and African horse-sickness, and where antigenic variations between strains of the same virus are marked. In the *third class* are placed viruses such as Psittacosis, Infectious Swine Pneumonia and Lymphogranuloma. The immunity conferred is short-lived although the viruses may persist for a long period in the host, and standard serological tests fail to demonstrate the presence of immune bodies.

It will be accepted that, in most respects, the virus of malignant catarrh falls into Class III. Immunity is of short duration, neutralising or complement-fixing bodies have not so far been demonstrated, and evidence to suggest that virus may persist in recovered animals is presented in this paper. The last point is of extreme interest and importance for it provides, if substantiated, an explanation of malignant catarrh in animals not in contact with known reservoirs of infection (wildebeeste and sheep). In an attempt to demonstrate the persistence of virus in the bovine host, a number of experiments were made.

Animal 3284, given 4.0 ml. of infective gland emulsion collected form animal 3886 after the 32nd routine passage, reacted 24 days later and after ten days of high fever and lachrymation it apparently recovered. At this point the animal was emaciated and there was an opacity of the right eye although it continued to eat well and, in other respects, appeared to be healthy. After a further ten days, a second mild and fluctuating temperature reaction was recorded, during which no positive clinical evidence of malignant catarrh was seen. On January 5, 1953, one month after the initial reaction and nearly two months after the animal had been inoculated, 400 ml. of blood were collected in citrate solution and 200 ml. given subcutaneously to each of two steers (3972 and 4232). Both these animals reacted and died within the usual period.

Meanwhile the donor (3284) lived eight days longer and died on January 13, 1953, fifty-nine days after inoculation. Apart from progressive emaciation and weakness, this animal showed no other clinical symptoms of disease until it collapsed. The examination post-mortem showed congestion and erosion of the turbinate mucosae, gross oedema and ulceration of the folds of the abomasum, large hæmorrhagic ulcers in the cæcum, and evidence of local infection of the myocardium of the left ventricle. One prescapular lymph gland was enlarged and both were grossly altered in texture. In view of the clinical history and the findings post-mortem, it seemed possible that this animal died of some infection, such as *F. necropherus,* secondary to malignant catarrh. Animal 3944 was given 8.0 ml. of prescapular gland emulsion and animal 3977 received 8.0 ml. of a mixed spleen and gland emulsion, both by the subcutaneous route. The latter animal reacted on the 17th day and died a week later. The former (9344) showed a mild temperature reaction between the 18th and 25th days after inoculation followed by a return to normal health but, unfortunately, it died of an intercurrent disease (Heartwater) before it could be challenged.

Another attempt to demonstrate the persistence of virus in the bovine host

was made using blood from steer 3652. This animal failed to react to an inoculation of infective material five months previously and its immunity was confirmed when challenge inoculations, given two and three months later, were successfully resisted. Animals 4244 and 3895 received subcutaneously 200 ml. of citrated blood which were collected. The results were disappointingly inconclusive. Animal 4244 showed brief temperature rises on the 11th and 36th days respectively after inoculation without other clinical evidence of disease. Nine weeks after inoculation this animal was challenged, but collapsed and died of an unidentified disease a week later. Animal 3895 did not react and when challenged two months later proved to be immune.

Discussion

The mortality rate of the virulent " head and eye " form of bovine malignant catarrh, as seen in East Africa, is high and it is not always easy to obtain recovered animals for observations on the duration of immunity. Only two cases of recovery from natural outbreaks were investigated in the work herein described and the results are of some interest. One animal, a Friesian cow, successfully resisted repeated challenges with homologous virus on four occasions, at two and a half, five, three and five months intervals respectively.

The question arises whether successive challenge inoculations reinforce an existing immunity to this disease, and, if so, whether this can occur without clinical evidence. In this connection it is of interest to compare animal 221, which received formalised vaccine, and was challenged on three occasions, at intervals of two, one and a half, and one month respectively. No reactions followed the first two challenges but the third proved fatal after an extended incubation period. In this case, therefore, the first two challenges did not reinforce existing immunity and when resistance began to wane, four a half months after vaccination, the third challenge proved fatal. Further evidence that immunity after successful vaccination or accidentally conferred by the inoculation of sub-lethal doses of infective blood is of four to eight months duration is gained from the histories of animals 122, 141 and 771.

From a critical examination of the cases here presented, the writer is inclined to believe that inoculation of infective material to animals resistant to bovine malignant catarrh has no effect unless their resistance has ebbed to a low level. In that case a response ranging from a mild temperature rise and reinforcement of immunity to a fatal reaction will occur. It is not suggested that very large amounts of infective material might not hyper-immunise a resistant animal, but it has already been noted (Piercy, 1952a) that the standard challenge dose used in these experiments does not contain virus to a very high titre.

Returning to the case of the Fresian cow which recovered from a natural infection, it is suggested that an immunity of at least eight months' duration was gained. Support for the persistence of immunity for this period is to be found in the case of animal 771 which survived an inoculation of infective blood and thereafter resisted challenge inoculations two and eight months later.

A six-year-old grade cow, the second case of recovery from natural infection,

reacted fatally when given "D" virus four months later, although in this instance the challenge virus was probably heterologous.

These experiments tend to show that the duration of immunity, naturally acquired or artificially induced, in animals which have recovered from bovine malignant catarrh is longer than was formerly supposed. The prospects of elaborating a method of artificial immunisation, therefore, may not be so remote as was thought. If resistance can be induced for six months or more, severe losses in stock exposed to outbreaks in enzootic areas might be substantially reduced.

The experiments with formalised vaccines were disappointing in that resistance to challenge inoculation with homologous virus was apparent only in two out of ten vaccinated animals. On the other hand, good reports were received after using similar vaccines in the field. The correct interpretation of these conflicting results may be that the method of challenge at the laboratory is considerably more severe than exposure to natural infection. The production of an efficient vaccine is probably largely qualified by the difficulty of obtaining material with a sufficiently high concentration of virus and this is not likely to be overcome until some method of liberating the virus from its host cells has been elaborated.

The results of efforts to demonstrate the persistence of virus in the living bovine host were somewhat equivocal. Thus blood from an animal, recovered from bovine malignant catarrh four months previously, produced what appeared to be a typical mild case of the disease when given to another animal but it was impossible to continue this series of observations. In another case, virus was demonstrated in the bloodstream of an animal two months after artificial infection. A third attempt, using blood from an animal whose immunity had been demonstrated by resistance to three challenge inoculations over a period of five months, was inconclusive as one recipient proved to be already immune and the other, which also failed to react, died of an intercurrent disease before it could be challenged.

These results, although disappointingly indefinite, lend some support to the view that virus may persist in the bovine host for periods of at least several months. It is important that this should be established or disproved by further experimentation, for herein may lie the answer to the persistence of bovine malignant catarrh in the absence of intermediate hosts such as sheep and wildebeeste.

Summary and Conclusion

Evidence is presented to show that the immunity of animals recovered from naturally acquired or artificially induced bovine malignant catarrh persists for periods of four to eight months or even longer.

On this basis, further attempts to elaborate an efficient vaccine seem justified. Formalised vaccines gave disappointing results when vaccinated animals were subjected to "needle" challenges at the laboratory but appeared to be successful in cutting short a severe outbreak in the field.

Attempts to demonstrate the presence of virus in the bloodstream of

recovered animals met with indifferent success but tended to support the view that virus may persist in the bovine host for several months. It is stressed that this view merits further investigation for its elucidation may explain the persistence of the disease in the absence of intermediate hosts.

Acknowledgments

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STUDIES ON ETHIDIUM BROMIDE

III. Toxicity Observations in Sudanese Cattle*

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Introduction

THE activity of ethidium bromide (2 : 7 diamino-10-methyl-9-phenyl phenanthridinium bromide) against trypanosome infections in cattle has been described by Wilde and Robson (1953), Wilson and Fairclough (1953) and Ford, Wilmshurst and Karib (1953). Another drug, dimidium bromide (2 : 7 diamino-10-methyl-9-phenyl-phenanthridinium bromide), whilst possessing useful therapeutic properties, has been shown to produce under certain conditions a syndrome of delayed liver damage with or without lesions of the skin, Thorold and

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Plowright (1952), Burdin and Plowright (1952). In Kenya, Burdin (1953) failed to produce this liver damage when ethidium bromide was administered to cattle in doses up to 4 mg/kg. With these findings in mind, it was felt desirable to investigate the toxicity of the drug under conditions pertaining in the Anglo-Egyptian Sudan.

Methods

The experiment was carried out on nineteen 1½-2-year-old bulls from the Northern Sudan. The bulls were tethered in shaded compounds and fed on burseem and durra stalks. They were protected against bovine pleuro-pneumonia with an attenuated serum broth vaccine and against rinderpest by the injection of lapinised virus. After the examination, on three consecutive days, of early morning wet blood smears, to detect any previous trypanosome infection, each bull was injected subcutaneously with 5 cc. of citrated blood from a natural case of *T.congolense* infection from the Malakal district. When all the animals showed trypanosomes in wet smears, fourteen days after the infection, drug treatment was carried out.

Seven bulls received ethidium bromide at a rate of 1.0 mg/kg. four received the drug at 5 mg/kg., four at 10 mg/kg. and four received dimidium bromide at a rate of 3 mg/kg. The drugs were administered in aqueous solutions by subcutaneous injection on the side of the thorax behind the scapula. The seven bulls receiving ethidium bromide at 1.0 mg/kg. were given a 1 per cent solution on the left side of the thorax and the other three groups of four bulls each were given the appropriate drug in 2 per cent solution divided into two portions and administered on both left and right sides of the thorax.

Liver biopsy by the method of Loosmore and Allcroft (1951) was carried out on all bulls on one occasion before drug treatment and a second liver sample was removed by biopsy from each of the seven bulls treated with ethidium bromide at 1.0 mg/kg on one occasion twelve weeks after treatment. Biopsies were performed on each of the twelve bulls in the other three groups at intervals of approximately three weeks from the time of treatment until they were slaughtered twelve weeks after treatment.

Van den Bergh tests were carried out on plasma from all nineteen bulls at weekly intervals for twelve weeks after treatment.

Results

1. *Clinical observations.*

All the injections produced a local reaction characterised by painful subcutaneous swellings, varying in size from 3 in. in diameter in the 1.0 mg/kg group up to two swellings of 10 in. diameter in the 10 mg/kg group. The reactions of the dimidium bromide group were comparable with those of the 5.0 mg/kg ethidium group. When observations were terminated twelve weeks after treatment the swellings had disappeared in the 1.0 mg/kg group, except that one animal had a skin scar about 1 in. in diameter. In the higher dose

groups, the swellings persisted, although they were not painful and much smaller in size than when at their height. Two of the dimidium injected animals and one of the 5.0 mg/kg ethidium group showed dry separating skin scars at the site of injection. There were no signs of jaundice in any of the bulls. About seven days after treatment two animals, Nos. 929 and 930 treated with ethidium at 10 mg/kg and one, No. 936, treated with dimidium at 3.0 mg/kg appeared dull and developed a muco-purulent discharge from the nose and eyes. The condition cleared during the next few days, but both of the ethidium treated bulls were found dead two and three weeks after treatment. At post-mortem there was considerable decomposition of the organs and no gross lesions were noted. Microscopically the kidneys showed fatty deposits in the cells of the tubules, but there were no significant changes in the liver.

In all nineteen bulls the blood was free of trypanosomes within forty-eight hours of treatment and this freedom was maintained during daily examination for twelve weeks.

2. *Liver biopsy and van den Bergh tests.*

The accompanying table shows the results of the liver biopsies and van den Bergh tests. Paraffin sections from the biopsies were stained with hæmatoxylin and eosin and frozen sections were stained with oil red 4 B. There was evidence of periportal fatty deposits in the liver from bull 934 (dimidium bromide 3.0 mg/kg) seven and ten weeks after drug administration. This bull also gave a positive direct van den Bergh reaction five and six weeks after drug admini-

Results of Liver Biopsy and van den Bergh Tests

Drug	Dose	Bull	Before Treatment	Weeks After Treatment 1	2	3	4	5	6	7	8	9	10	11	12
		931	— B	—	—	—	—	—	—	—	—	—	—	—	— B
		950	— B	—	—	—	—	—	—	—	—	—	—	—	— B
Ethidium bromide	1.0 mg/kg	915	— B	—	—	—	—	—	—	—	—	—	—	—	— B
		935	— B	—	—	—	—	—	—	—	—	—	—	—	— B
		956	— B	—	—	—	—	—	—	—	—	—	—	—	— B
		949	— B	—	—	—	—	—	—	—	—	—	—	—	— B
		913	— B	—	—	— B	—	—	— B	—	—	— B	—	—	— B
Ethidium bromide	5.0 mg/kg	925	— B	—	— B	—	—	— B	—	—	— B	—	—	— B	—
		893	— B	—	—	—	— B	—	—	— B	—	—	— B	—	—
		916	— B	—	—	— B	—	—	— B	—	—	— B	—	—	— B
		16	— B	— B	—	—	— B	—	+	— B	—	—	— B	—	—
Ethidium bromide	10.0 mg/kg	959	— B	—	— B	—	—	— B	—	—	— B	—	—	— B	—
		929	— B	—	—	died									
		930	— B	—	died										
		936	— B	—	—	— B	—	—	— PF	—	—	— B	—	—	— B
Dimidium bromide	3.0 mg/kg	923	— B	— B	—	—	—	— B	—	—	— B	—	—	— B	—
		924	— B	—	— B	—	—	— B	—	—	— B	—	—	— B	—
		934	— B	—	—	—	— B	+	+	— PF	—	—	— PF	—	—

B = No abnormality in biopsy tissue; P.F. = Slight periportal fatty deposits;

— = Negative result to van den Bergh test; + = Positive direct van den Bergh test.

stration. Bull 936 (dimidium bromide 3.0 mg/kg) showed periportal fatty deposits in liver removed six weeks after treatment but no positive van den Bergh test. Bull No. 16 (ethidium bromide 10 mg/kg) gave a positive direct van den Bergh test six weeks after treatment and no vacuolation of periportal liver cells was seen in the paraffin sections. Unfortunately there was insufficient biopsy material seven and ten weeks after treatment to provide frozen sections and so it is not possible to say that very slight periportal fatty deposits did not occur. Post-mortem material taken twelve weeks after treatment from the ten remaining bulls in the 5.0 and 10.0 mg/kg ethidium bromide and the 3.0 mg/kg dimidium bromide group was examined. Sections showed proliferation of bile ducts and production of new cells in the portal systems of bulls 934 (dimidium bromide 3.0 mg/kg) and 893 (ethidium bromide 5.0 mg/kg). In six out of the seven of these bulls from which kidney sections were available there was glomerular congestion and interstitial infiltration by mononuclear cells. This cellular infiltration, which has also been seen in untreated Sudanese cattle, is described by Burdin and Plowright (1952) as commonly occurring in cattle slaughtered at Kabete and is probably unrelated to drug administration.

Discussion

In this comparison of the effects of single doses of ethidium and dimidium bromides on Northern Sudanese cattle all animals under test were infected before treatment with a virulent strain of *T. congolense*. This was done because reports of toxicity from the field had suggested that skin lesions were more severe and deaths occurred more frequently when dimidium bromide was given to infected animals than was the case when treatment of uninfected animals was carried out.

In this experiment neither deaths nor skin lesions occurred following dimidium bromide administration at 3.0 mg/kg, but histological examination of the liver showed periportal fatty changes in two animals and one of these animals also gave a positive direct van den Bergh test at the critical period after dosing. When ethidium bromide was administered at a level of 10.0 mg/kg two deaths occurred one and two weeks after treatment and fatty deposits were found in the kidney tubules at post-mortem. A third animal in this group of four gave a positive direct van den Bergh six weeks after dosing and the possibility of liver damage cannot be ruled out because there was insufficient material from the liver biopsies at the critical period. Four animals treated with ethidium at 5.0 mg/kg and seven treated at 1.0 mg/kg showed no ill effects

The liver damage in bulls 16 (ethidium bromide 10.0 mg/kg), 936 and 934 (dimidium bromide 3.0 mg/kg) was transient in nature and not associated with clinical jaundice or obvious loss in condition, although regular weighings were not carried out. At Kabete, Burdin and Plowright (1952) have been able to produce regularly liver lesions with single doses of 2 and 3 mg/kg of dimidium bromide, but failed to do so with ethidium bromide at doses up to 4 mg/kg. Under British conditions, Wilson (1954) produced a typical liver lesion followed by death in one out of two cattle dosed with dimidium bromide at 3.0 mg

per kilo. The other of these two animals and two animals given ethidium bromide at 10 mg/kg showed by liver function tests a transient lesion from which they slowly recovered.

It is interesting to speculate on the cause of the mild and transient nature of the liver damage in the Khartoum bulls. Burdin and Plowright postulate an interference by the drug in the biological methylation of the essential metabolites choline, nicotinic acid and riboflavin. It may be that an animal growing rapidly or grazing widely for food would have higher requirements of these metabolites than tethered animals on a maintenance diet as were the bulls at Khartoum. Carmichael (1950) has suggested that some factor peculiar to Africa is necessary to render cattle susceptible to drug toxicity, whereas Wilson was able to reproduce liver damage in Britain, although skin lesions did not occur.

Whatever the factors affecting the toxicity of the two drugs, the results in the Sudan support the findings of Burdin and Plowright in Kenya and Wilson in England that a higher dose of ethidium bromide than of dimidium bromide may be administered without producing delayed liver damage. As the therapeutic levels of the drug are similar; 1.5 mg/kg for dimidium bromide and 1.0 mg/kg for ethidium bromide, then it is clear that ethidium bromide has a greater therapeutic index.

Summary

Treatment of four cattle with ethidium bromide at 10 mg/kg was followed by the death of two and transient liver damage, as demonstrated by the van den Bergh test, in one of the other two. Two of four cattle given dimidium bromide at 3 mg/kg showed transient liver damage, whilst seven cattle given ethidium bromide at 1.0 mg/kg and four which received ethidium at 5.0 mg/kg showed no signs of liver damage as revealed by the examination of biopsy material and van den Bergh tests. All animals had a reaction at the site of injection and this reaction varied in size according to the amount of drug administered.

Acknowledgments

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CHOKE

By O. V. GUNNING, D.V.M., F.R.C.V.S.

Acle.

IT must be admitted that in the treatment of choke in both horses and cattle there is no finer way for a practitioner to enhance his reputation than by relieving the animal immediately. This is especially so, if he can at the same time hand the owner the offending body. Veterinary practice, however, does not always work to plan. The size and layout of the premises, the temperament of the subject, lack of suitable assistance and not least the nature and position of the obstruction frequently make operative procedure an extremely risky and hazardous business.

We have encountered our fair share of fatal cases but in each one, the animal has died from the treatment and not from the choke. Most mature practitioners recognise that horrible gurgling sound accompanied sometimes by an area of emphysema; a sure sign that the œsophagus has already been ruptured by some well-meaning person before his arrival. It is in fact most necessary to look for this and if present warn the owner that it will be a salvage case before starting manual examination. At other times the surgeon may be met with the remark: "You were not at home so we thought we had better give it a drink," and the respiratory symptoms tell that there is probably a pint of oil in the lungs.

For this reason it is felt there is often a tendency both with teachers and in books to over-emphasise the operative side. Of course the fault may be ours and in any case we entered our professional career with the conviction that if an animal was choked, the immediate thing to do was to try and remove the obstruction. The writer is thankful to be able to say he has avoided doing permanent injury with a probang. The reason for this is not skill but because he learnt early to dispense with its use.

On the other hand he still retains most humiliating memories of one case. An urgent message was received late one Easter Saturday afternoon to attend a heavy milking cow, which was in full profit. A large piece of turnip was found wedged well back in the pharynx. It was possible to obtain a fair finger grip as one so often can, but in spite of youth and activity effort after effort failed to dislodge it. The owner was anxious as owners always are. The misfortune was the operator was anxious too. The beast was not blown so it was decided to cast her and dislodge in the recumbent position. The animal fell nicely, in fact so far everything went according to plan, and with some difficulty and effort the obstruction was removed. Triumph was, however, extremely short lived as the animal gave one gasp and was dead.

Not long afterwards an almost identical case was encountered. By this time operative enthusiasm had somewhat cooled. After a number of fruitless efforts to dislodge and making sure there was no danger of tympany the case was left until the following morning. Being singlehanded and receiving no word from the owner, the case was not actually seen until the following afternoon. The piece of turnip was then found in exactly the same position but

greatly to our surprise it could be removed with practically no effort. In spite of having been continuously bathed in saliva the portion removed was dry and beginning to shrivel. It was of quite different texture to similar pieces which it has been possible to remove at once. The question, therefore arose, why be in such a hurry to operate?

For the past 30 years a waiting policy has been adopted in all classes of choke which resist early removal and from experience the one danger of choke in cattle is suffocation through tympany. If there is distention of both flanks a trochar can be inserted immediately and if necessary fixed in position and left. All food and edible bedding should be taken away and a hypodermic injection can be given of a small dose of a peristaltic stimulant. Most recommended treatments have been tried out with apparently equally successful results. One thing has been found, namely, inactivity is the very worst course to adopt.

A probang is included in the equipment carried. This assures the owner that it is available for use if required.

It is unusual for more than two visits to be made. Some cases hang fire but only one case is recalled when it was necessary to perform œsophagotomy. In this case the waiting attitude did fail, and a tennis ball was removed from the lower cervical region of a first calf Friesian heifer. It was impossible to follow the case up to completion as the beast was barren and was fed for slaughter after the operation.

Choke in Horses

With one exception the waiting attitude in horses has been equally successful. In the case of dry beet pulp it is necessary to take immediate action. A stomach tube is passed down on to the obstruction and about two pumpfuls of saline or water are directed on to the mass and the pump disengaged and the end of the tube directed towards the ground. In this way it is possible to syphon out large quantities of pulp. The operation may take an hour or more or it may be advisable to rest the animal and repeat the process later. The rest period has an advantage in that the obstruction may clear itself in the meantime. If it has not, the tube will gradually go down further and further until it finally enters the stomach. It has been suggested that the horse's head should be tied to the ground but the writer has never found this advisable or necessary. Beyond a slight cough for a few days recovery is invariably uneventful.

A frequent cause of choke in the old days was when hungry horses returned to the stable at night and the corn bin had been left open. The leading animal would grab a large mouthful but owing to pressure from the horses behind, be forced to bolt it. Such cases although often alarming at the time if left unmolested would in due course clear themselves.

Forced exercise has been recommended as beneficial, but one's experience with horses is that it is invariably fatal. Three such cases. A farmer had one horse put on a binder with the expectation of removing a choke. A second

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belonging to a coal merchant was hitched to a coal cart. A third was sent to plough. All these animals died. Unfortunately in no case was it possible to make a post-mortem examination.

The treatment is best described by Steffen whose article in the writer's opinion is a classic on the subject. Although the title is " Choke in the Horse," in my view his recommendations apply equally to cattle. A summary of what he says will well bear repetition. He states as follows:—

" If there is a condition in veterinary practice in which the veterinarian must demonstrate tact and absolute control of the client (not the patient) this is certainly the one. In all these cases the owner or attendant is to be taken firmly in hand. Often this takes as much judgment on the part of the attending surgeon as the treatment of the case in hand. Usually they have heard of, or seen used, probangs (buggy-whips, broom handles, traces, and what-not in the form of probangs) and they want an immediate demonstration of similar tactics. They want to rub and massage the neck, pour into the animal quantities of oil, and do a thousand and one other things.

" Ninety-five per cent of all chokes are really very benign conditions when treated early. In many cases it is the treatment administered that transforms the case into a really grave one.

" I do not fear contradiction when I say that nearly all chokes would be relieved spontaneously if the horse were at once placed where he could get nothing whatever to eat but plenty of water to suck up. In œsophageal choke the water taken is usually ' sucked ' tentatively." . . . After some details on the pathology Steffen describes his treatment. A loose-box or stall swept clean and a bucket of water. He then gives two grains of pilocarpine hydrochloride hypodermically, after which salivation starts usually in five or ten minutes. The veterinary surgeon and all others serve the patient best by going away and leaving him alone. In a good deal more than half of all the cases of choke, all evidence of its existence has passed off at the end of three hours following this line of treatment. If recovery has not taken place after three or four hours from this treatment Steffen states he has used successfully, for a number of years, an injection of one grain apomorphine hypodermically. He continues: " After the injection of apomorphine, five or six hours are allowed to elapse before anything further is attempted. Should the choke still be in evidence at the end of this time (a very rare occurrence) the surgeon can begin to think of operating. Talk to your client and prepare him for what you may have to do, but do not do it yet. Allow another five or six or even ten or twelve hours to pass with the horse kept in the clean stall as before. The chances are you will be very pleased over your good judgment at the end of this time; your client will be even more so.

" If you should be so unfortunate as to meet with a case of real jabot (that is what you undoubtedly have when the foregoing procedure fails) your patient is just as good a subject for the necessary operation if you have not allowed him to swallow any food since he became choked, as he was when you first saw him.

You have used good, sound and expert judgment and have not harmed your client or his horse. You have given them both every possible chance. Then operate according to the directions given by Merrillat.

" Here I can promise the surgeon that his operations for choke in horses will be few and far between if he follows patiently the instructions outlined above."

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THE HEART OF THE CAMEL

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Introduction

ALTHOUGH the hearts of most domesticated animals have been fully described, very little is known about that of the camel. I therefore thought of adding new knowledge in connection with the anatomy of the heart of that animal showing its characteristic features, which I hope will benefit science and practitioners.

Chauveaux (1891) mentions that besides the ox, a small cross-shaped bone is found in the heart of the sheep, pig, camel, deer, giraffe and sometimes in the horse.

Leese (1927) states that the heart of the camel has a rather pointed apex, and that there are only two venticular grooves; he adds that as in many other ruminants, the organ contains a small bone in the adult.

Lesbre (1903) states that the heart of the camel resembles that of solipeds except that the right venticular groove is much nearer to the caudal border of the organ than in solipeds and that Vallons gives the following weights:—

Male No. 1 ...	1,400 gr.	Female No. 1 ...	1,319 gr.
Male No. 2 ...	1,415 gr.	Female No. 2 ...	1,290 gr.

He mentions that its position and relations resemble that of other big domestic quadrupeds except that its costal surface is extensive, particularly on the left side. He adds that the most advanced part of this organ does not extend beyond the third rib and the lower is not beyond the sixth and that the apex rests obliquely on the sternum in the angle of insertion of the diaphragm. With regard to the internal structures, Lesbre mentions nothing but a pillar of second type in the lower part of the right ventricle, nearly as thick as the little finger. He also mentions that Leuchart and Mayer described a small ossification in the thickness of the aortic zone, but Lesbre himself found it weak in one animal and adds that Vallons looked for the two small bones which are found in the hearts

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of other big domesticated ruminants. Lesbre concludes that nothing of note is seen in both the pericardium and the structure of the heart.

Materials and Method

The hearts of about 40 camels slaughtered in Cairo Abattoir were dissected in detail and their measurements and weights were recorded.

Literature

Macroscopical Examination

Examination reveals that the average proportion of the weight and size of the heart of the camel to its body is much less in comparison with the proportion of same in other domesticated animals. Its average weight is about 0.61 per cent of the body weight. It is markedly broad at the coronary grooves, slender and more pointed at the apex resembling a long slender funnel. The external features of the heart shows that its proximal three-fourths is wider and nearly quadrilateral, beyond that it suddenly narrows and becomes rounded forming the apex. Two distinct characteristic features are observed in the heart of the camel; one of these is that the distal, third of the left ventricle of the heart, is strongly oblique and markedly curved, being directed to the left and not vertical (see Figure 1). The other, is that the right side of a fresh heart which is formed of the right atrium and the right ventricle is very flabby, while the left side is thick and hard forming a long uniform circular cone (Figure 1).

The heart of the camel is obliquely situated on the left side extending from the second intercostal space or third rib in front to the end of the fifth intercostal space or sixth rib behind. Its base lies under the bodies of the thoracic vertebræ from the second thoracic vertebra to the fifth one. The apex lies obliquely on the left side just above the sixth sternebra of the sternum. The average weight of the heart of the camel differs according to age and size; in the young animal it is about 2.5 lb., while in the adult its average weight is about 5 lb., and it may increase, but it never is more than 8 lb, which is recorded in one case only belonging to a large animal. In an adult camel, the circumference of the heart is about 13 in. at the coronary groove, while it is 10 in. a little above the apex. On the other hand, the longitudinal circumference from the root of the aorta to the apex of the heart is about 19 in.

The external surface of the heart of the camel carries a great quantity of fat, which covers the whole length of the coronary and longitudinal grooves. The greatest bulk of this fat lies on the left side filling the coronary groove between both auricles, where it forms a thick belt around the root of both the pulmonary artery and the aorta; beyond that it extends across the left longitudinal groove decreasing in quantity till the apex of the heart, where it is continuous with the right longitudinal groove.

The cranial border of the heart is slightly convex in its proximal two-thirds formed by the right ventricle, after which it is markedly convex and is formed by the left ventricle. On the other hand, *the caudal border* is formed mainly

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by the left ventricle; it is nearly straight proximally, while in its distal third it is markedly concave owing to the marked obliquity of the apex. The left longitudinal groove is short, deep, and markedly curved, forming a distinct belt around the heart. It appears to divide the heart into a proximal broad quadrilateral part and a long, slender, oblique apex below. It begins faintly just below the root of the pulmonary artery; passing downwards and forwards, it crosses the cranial border of the heart deeply, and ends on the distal part of the right side a little above the apex, where it meets the right groove. The right longitudinal groove is slightly curved and is much shallower, wider and shorter than the left one; it begins from the right side just below the termination of the caudal vena cava; passing backwards and downwards, it ends on the caudal border near the apex. The intermediate groove is present; it forms a small, narrow, distinct, short groove extending from the coronary groove down the left side of the caudal border and ends a little above the middle of the heart; on both sides of this groove, some few faint grooves are seen descending from the coronary groove downwards.

The right atrium is small, its wall is thin and very flabby, while its auricle forms an elongated, narrow, oblique triangle with a pointed apex directed forwards and upwards, ending with a small teat-like process. The auricle is clearly separated from the atrium, being attached to it by a narrow, short neck. Its distal margin is slightly convex and, unlike that of the ox, it is free from serrations. The interior of the auricle is lined by numerous minute, regular, intersecting pectinate muscles which form a highly developed network. These are distinct and surround very minute cardiac veins between them. *The right ventricle* is smaller in size when compared with those of both horse and ox. It is short and more regularly triangular, its wall is thin and very flabby, while its apex extends to about near the apex. The atrio-ventricular orifice is relatively wide and is guarded by the usual three principal large valves, two on the wall and one on the septum. The valves are broad, large but very thin; they are provided with small, weak but numerous chordæ tendinæ. The papillary muscles are distinct and well developed; a very large, strong, broad one springs by two thick, small roots from the wall near the apex and soon gives two branches, of which one gives origin to the chordæ tendinæ attaching one of the cusps to the wall, and the other gives origin to a large, strong moderator band which passes dorso-caudally to end in the middle part of the septum. Just below this band, or in close contact with it, a slender ventral but much smaller one passes parallel with the dorsal one from the wall to the septum. Other few, thick, intersecting papillary muscles surrounding large foramina occur at the entrance of the conus arteriosus opposite to the wall of the right ventricle.

The left atrium is smaller and is characterised by a special white, thick, smooth, fibrous membrane lining its interior. Its auricle is large, nearly rounded, and forms a short, wide, ear-shaped projection. Its ventral free margin presents few but much deeper, rounded and wide serrations, while internally it is studded with numerous thick pectinate muscles. Only from four to five large veins

brings aerated blood from both lungs to the atrium. *The left ventricle* is narrow and its wall is very thick. Its cavity is somewhat oblique in its distal part, following the obliquity of the apex. The auriculo-ventricular opening is somewhat narrow and is guarded by two thick, broad, strong valves which are covered by thick, white, fibrous membrane on its dorsal surface. These cusps are provided with long, strong, thick and well-developed chordæ tendinæ. Two large, strong papillary muscles arise opposite to each other; one springs about the middle of the wall and gives origin to a group of strong, thick chordæ tendinæ, the other springs from the septum. Other numerous papillary muscles are spread all over the wall and the septum except at the entrance of the aorta, which is free from such papillary muscles. Near the apex, these muscles form a small, parallel, oblique, slender, ladder-like on the septum.

It is important to note that the aorta in the heart of the camel is very large, strong and thick walled. The brachio-cephalic trunk is represented by two small arteries, lying on each other, arising directly from the convexity of the arch of the aorta. The proximal smaller artery represents the left axillary artery in the horse, while the large ventral one represents the brachio-cephalic artery. The semilunar valves of both the aorta and the pulmonary arteries are formed of three large, thin-walled cusps. Just in front of the bifurcation of the pulmonary artery, a thick, strong, rounded ligament (lig. arteriosum) extends dorso-caudally to end in the concavity of the aortic arch from the left side. With regard to the pericardium covering the heart, it forms a very thick, strong and more opaque sac. The pericardial fluid is more capacious and gelatinous and is more in quantity than in those of other domesticated animals; it is about 200 c.c. in the heart of an adult camel.

The ossa-cordis (Fig. 2) in the heart of a camel, unlike that of the ox, is formed only of one bone, the right larger one; while the left smaller one was absent in all specimens examined. The bone is weak and more slender. It develops in the right half of the aortic fibrous ring opposite to the atrio-ventricular rings. It forms a transversely elongated, narrow but more regular triangle, of which the more cranial half is narrower and somewhat cartilaginous, while the caudal one is ossified and broader. The right surface of the bone is convex in both directions; the corresponding left surface is concave and gives attachment to the right posterior cusp of the aortic valve.

Microscopical Examination

A section in the heart of the camel reveals that it is not unlike that of other domesticated animals. It presents the usual three layers: the myocardium, the epicardium and the endocardium. The muscular tissue (myocardium) presents cross-striation, but somewhat larger fibres with single nucleii. The acrolar tissue surrounded by the muscular bundles (for blood vessels) is distinct (Fig. 3).

Examination of different sections of hearts of both sheep and camels in

this investigation reveals the absence of what are called Purking fibres from the heart of the camel. These fibres are a characteristic feature found under the endocardium of the hearts of sheep; they form square-shaped cells with two nucleii, and from these fibres originates the contraction to all the heart.

Conclusion

From what has been mentioned above, it is evident that the heart of the camel, unlike that of other domesticated animals, presents some important characteristic features. Although it is broad at the base, yet it is slender and more pointed at the apex. The great quantity of fat on its external surface, the marked obliquity of its apex, and the flabby character of its right half, together with the belt-like shape of its left longitudinal groove, are features which can be observed from the first sight. Moreover, the great size of the aorta and the thickness of its wall are also noticeable. The intermediate groove is present, and this statement is in disagreement with what Leese mentioned about the absence of such groove in the heart of the camel.

Acknowledgment

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PLATE I.

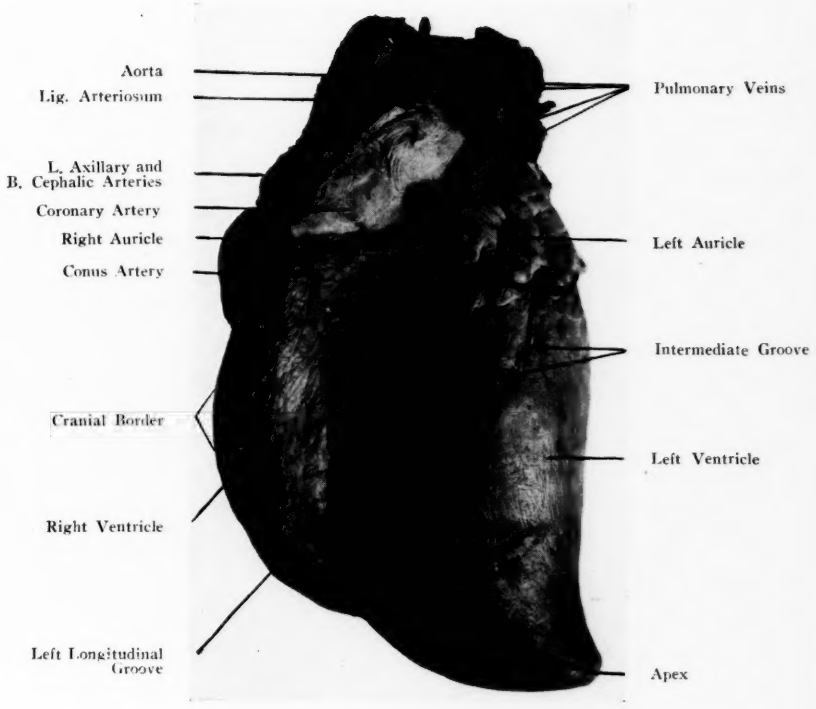
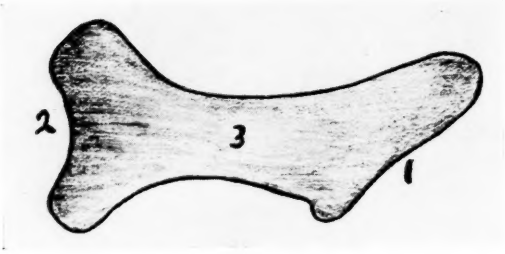


Fig. 1

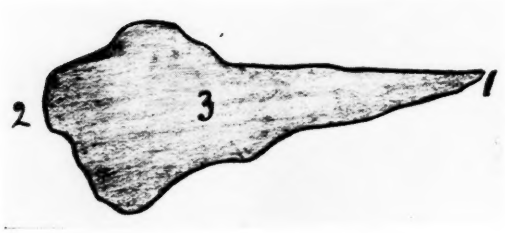
The heart of the camel—left view.

(*Article by Hegazi, page* 104)

PLATE II.



Os-Cordis of Ox



Os-Cordis of Camel

Fig. 2

1. Cranial end. 2. Caudal end. 3. Right Surface.

Fig. 3

(*Article by Hegazi, page* 104)

ABSTRACTS

THE INCORPORATION OF ANIMAL FATS IN ANIMAL FEEDINGSTUFFS.

FATS as by-products of the slaughtering industry first met competition with the development of vegetable fats in the manufacture of margarine, cooking fats and for soap making. The discovery of the synthetic detergents has further decreased the market for animal fats, and endeavours are being made, in the U.S.A., to find uses for surplus animal fats. Dr. H. R. Kraybill, director of research of the American Meat Institute Foundation, in the December 5 issue of *Feedstuffs,* suggests that inedible animal fats might, with advantage, be incorporated into feedingstuffs for dogs, poultry and other livestock. The disadvantage of a high fat content in feedingstuffs has been the relatively short period of freedom from rancidity. The development of anti-oxidising agents, such as butylated hydroxyanisole, makes it practicable to utilise animal fats in feedingstuffs which remain free from excessive free fatty acids for a year or more when stored at room temperatures. It is claimed that the nutritive value of such fortified feedingstuffs would be improved and that the cost of the energy derived from such fats would be competitive with that derived from carbohydrates. Meals having a somewhat higher fat content than normal have a better appearance, " handle " easily and flow more readily. When fat is added to a ration, it is necessary to bear in mind the reduction in concentration of other nutrients, through dilution, and to ensure that the margin of other nutrients meets the requirements after the addition of stabilised fats. Dr. Kraybill quotes figures which show that if 2 per cent of fat were added to half of the total commercial feed production, a substantial part of the surplus of tallow and grease would be utilised. Obviously this would be of great benefit to the livestock industry and the national economy.

Dr. Kraybill's suggestions apply with no less force to Great Britain, but agriculturists have become so accustomed to demand low fat contents in feedstuffs that the introduction of fat-reinforced feedstuffs may well not be acceptable, until it is shown that rancidity can be arrested and such feedstuffs used to advantage.

THE EFFECT OF ADRENAL STEROIDS, CORTICOTROPHIN, AND GROWTH HORMONE ON RESISTANCE TO EXPERIMENTAL INFECTIONS. The Journal of Experimental Medicine, Rockefeller Institute for Medical Research, January 1, 1954. Vol. 99, No. 1. Edward H. Kass, Marguerite M. Lundgren and Maxwell Finland.

CORTISONE acetate, hydrocortisone acetate and hydrocortisone depress the resistance of mice to pneumococcal and influenza viral infections. Pituitary adrenocorticotropin does not significantly alter the resistance of mice to these experimental infections, even in doses which may cause profound eosinopenia, lymphopenia, and weight loss, and which are at the limit of tolerance of the animals. Corticosterone depresses resistance to pneumococcal infections significantly, but fails to alter resistance to influenzal viral infections. The findings suggest that murine adrenals may produce one of the known adrenal steroids

such as corticosterone along with another steroid, or may produce a steroid other than cortisone, hydrocortisone or corticosterone.

When resistance is decreased by adrenal steroids, the survival time is invariably shortened and the effect of the steroid hormones is frequently demonstrable within the first day after infection with pneumococci, making it unlikely that the depression of resistance that is seen is primarily due to depression of antibody formation.

REVIEWS

THE AMERICAN GRASS BOOK—*A Manual of Pasture and Range Practice,* by Sellers G. Archer and Clarence E. Bunch. Norman, Oklahoma, University. Oklahoma Press. Price $3.95.

THE average British veterinarian may, at first sight, consider that such a book as this is not of any great interest to him and that it should more particularly appeal to those engaged in other branches of agriculture. We would, however, strongly recommend this book to our readers, not as having an immediate bearing upon their daily work but rather as one to be profitably read in leisure hours. A knowledge of the wider aspects of farming is an indispensable asset to the country veterinary surgeon. No member of the profession can read this book without widening his mental outlook and gaining a more comprehensive view of man's dependence on the soil and its ubiquitous partner.

It is inevitable that a book dealing with grass must be related to the animals which grass so largely supports and there is much one can learn from its pages on the preparation of pastures for livestock grazing, early bite and conservation of grass for winter use.

Although written primarily for the North American reader, many of the problems of soil erosion, the part grass plays in the conservation of moisture and the development of soil nutrition is of world-wide importance and is of no small moment even to this country and, to a much greater extent, to the British Commonwealth. Mismanagement of grass has produced its inevitable calamitous sequelæ in many lands, and an increasing world population demands remedial measures as an urgent necessity. This work details the results of thirty-five years of assembling and studying information gleaned in the realm of reclamation and improvement of grasses and grassland. Conditions are so varied, and the territory in the U.S.A. is so vast, that types of pasture land vary enormously and the lessons to be assimilated from reading this book are of almost universal application.

The volume is written in easily readable language and in an interesting style, is profusely illustrated and well printed on good quality paper. Many not directly connected with the land will acquire a better understanding of the problems of agriculture by reading this book, whilst those whose interest lies with the soil cannot but benefit by its possession. An extensive bibliography is given at the end of the work.

One can conclude by quoting from the words of John James Ingalls which

follow the Foreword. "Next in importance to . . . water, light and air . . . may be reckoned the universal beneficence of grass . . . Forests decay, harvests perish, flowers vanish, but grass is immortal. It yields no fruit in earth or air, and yet should its harvest fail for a single year, famine would depopulate the earth. Grass softens the rude outline of the world. Its tenacious fibres hold the earth in its place. It invades the solitudes of deserts, climbs the inaccessible slopes and forbidding pinnacles of mountains, modifies climate, and determines the history, character and destiny of nations."

THE BRITISH VETERINARY CODEX 1953. London: The Pharmaceutical Press. Pp. xxiii. 737. Price 45s. net.

THE publication of the British Veterinary Codex is an important event in the progress of veterinary medicine. The purpose of the book is to present standards for substances and preparations used in the prophylaxis and treatment of animal diseases in the United Kingdom, the British Commonwealth and other countries, thus providing a basis for transactions in veterinary drugs. The veterinary surgeon can now be assured of the constant strength of the preparations he prescribes wherever he may obtain them. The book also provides a means for the pharmacist who dispenses them to check doses when he is directed, in the case of suspected errors, to ensure that the prescriber's intentions have been correctly interpreted.

The adoption of uniform standards is an essential for both science and commerce and in the biological standardisation of drugs, hormones and therapeutic substances it is the *sine qua non*. It seems remarkable that veterinary medicine has been able to progress for so long in the absence of official standards for many drugs. In some respect credit is due to the manufacturers of veterinary products who have themselves established standards and laboratory control of their preparations. The Codex Committee have rightly given credit to the assistance and ready collaboration they have had from commercial houses. The book has been published by the Pharmaceutical Press under the general editorship of Dr. K. R. Capper, Ph.D., B.Pharm., F.P.S., D.I.C., through a Committee, appointed in 1950, including veterinary surgeons, pharmacists interested in veterinary pharmacy and the secretaries of the Royal College of Veterinary Surgeons, the British Veterinary Association and the Pharmaceutical Society. The chairman of this committee was Mr. C. W. Mablethorpe, F.P.S., F.R.I.C., A.M.I.Chem.E. The committee appointed four sub-committees—the Action and Uses Subcommittee with Dr. J. Carmichael, C.M.G., D.Sc., M.R.C.V.S., Dip.Bact., as chairman; the Biological Products Subcommittee with Dr. R. F. Montgomerie, Ph.D., B.Sc., F.R.C.V.S. as chairman; the Formulary Subcommittee with Mr. A. G. Fishburn, F.R.I.C., F.P.S., as chairman and the Analytical Standards Subcommittee with Dr. D. C. Garratt, Ph.D., B.Sc., F.R.I.C. as chairman. Two subsidiary subcommittees were appointed for Antibiotics and Hormones under the chairmanship of Dr. R. Scarisbrick, Ph.D., M.A., M.R.C.V.S., A.R.I.C. and Dr. R. F. Montgomerie respectively.

The book is divided into three main sections preceded by a general intro-

duction and with the addition of some sixteen appendices. There is a most useful therapeutic and pharmacological index at the end. Part I consists of monographs for some 400 drugs of established use in veterinary medicine. The headings are in English with subheadings in Latin. The monographs define the drugs and their chemical constitution or biological origin. Standards are prescribed where possible for purity and activity. A large proportion of these drugs are official in the British Pharmacopœia or the British Pharmaceutical Codex and the Veterinary Codex has rightly insisted that these substances shall conform to the requirements of these publications. This is a wise decision avoiding a multiplicity of drugs in commerce and the substitution of substandard materials in veterinary medicine. Some drugs, which are peculiar to veterinary medicine, are described for the first time, and some others, notably Veterinary Cod Liver Oil, Kaolin, Magnesium Sulphate, Sodium Sulphate and Ferrous Sulphate are different to those used in human medicine either because of economic dictates or because of special requirements in animals. The monographs describe the actions and uses of the drugs, give recommended doses and describe the signs and treatment of toxic effects. In compiling this information the Actions and Uses Subcommittee have carried out a formidable task most commendably and the result of their labours constitutes an invaluable contribution to veterinary pharmacology and therapeutics. The actions of drugs in the various species is bewildering, morphine being an outstanding example, and the committee have drawn attention to the gaps and paucity of information on the actions of some drugs in farm animals. This should promote research in which the practising veterinary surgeon can take part. At the end of each monograph is a list of names of revelant preparations together with the page on which they appear. This greatly facilitates the use of the book and the finding of required information.

Part II deals with Antisera, Vaccines and related substances. This is a very important section, for a close control on the potency and purity of these preparations is essential to ensure that they have a therapeutic value and a freedom from toxic actions. The number of products, some 61, reflects the importance of immunology in veterinary medicine to-day and bears witness to the great advances in this subject since the pioneering discoveries of Ehrlich. The monographs meticulously prescribe methods for storing, labelling and types of container. Methods are described for determining potency, where possible, and tests are introduced for ensuring the absence of undue toxicity. The actions and uses as well as doses of these preparations are also described.

Part III is the Formulary and describes preparations commonly used in veterinary medicine. Not all are peculiar to veterinary medicine and some are well-known formulations official in the British Pharmacopœia or British Pharmaceutical Codex. There are some notable omissions, e.g., Scott's Dressing, and the veterinary surgeon may be surprised at the absence of some of his favourite remedies. However, the Committee have had to wield the axe to limit the number of preparations to reasonable proportions. It is remarkable that some 46 different tablets are described but there are only nine mixtures. Tablets have of necessity to be standardised since many of them require special manu-

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facturing procedures, whereas it is easy to vary constituents of mixtures according to the wishes of the individual prescribers. Some of these preparations are peculiar to veterinary pharmacy and it has been suggested by Mr. Fishburn that the methods of dispensing them should be introduced into the pharmacist's academic training (*Pharmaceutical Journal*, 1954, *172*, 110). Each preparation is preceded by a brief description of the general principles of its production, giving the veterinary surgeon an insight into veterinary pharmaceutics and a guide for prescribing.

The appendix is largely the concern of the analyst and the manufacturer. Reading it will give an appreciation of just how much does go into the production of veterinary products. Attention is drawn to appendices 15C, D and E which give valuable conversion tables for the Metric-Imperial System. Throughout the Veterinary Codex doses are expressed in the metric system, approximate imperial equivalents being given in parentheses for all substances and preparations commonly used in the imperial system.

The book is clearly printed on good quality paper and is attractively bound in a green leather cover embossed with gold letters and the coat of arms of the Pharmaceutical Society. The Society's motto, *Habenda Ratio Valetudinis*, printed on the coat of arms, and meaning "We must pay attention to health," adequately expresses the purpose of the book. The Pharmaceutical Press can be proud of having pioneered and published in so short a time such an excellent book which will do much to promote the advance of veterinary medicine and to forge a closer link between the veterinary surgeon and the pharmacist in their common problems.

TWO MEN AND A DOG, by John Montgomery. London: Eyre & Spottiswoode. Price 10s. 6d. net.

THIS is a story of two men, a country cottage and a dog. The dog, a cross-bred spaniel, was rescued by Pat in the nick of time from the Battersea Dogs Home. We do not know his previous history, but it is obvious as the story is told that he crept into the hearts of his new owners in such a way that their lives were orientated afresh and he became the "King" of two willing slaves. I suspect that the cottage by the heath was acquired by his command and for his pleasure. "Gruffy" and his two attendants became immersed in the village life. The village is quite near London but its rural charm is protected by a heath. When the bureaucrats wanted to despoil it by a by-pass arterial road, so that the city road hogs could get to the coast without a lot of hindrance, Mr. O'Connel, the village "Hampden," led the revolt and with great success. Most villages have their Ben Marwoods who seem to get the best out of life with a minimum of effort, and then there was Mrs. Cumberpatch, who knew everybody's business as well as her own. In most villages also the centre of life and information is the shop which sells everything, and the Blake emporium was no exception.

The most sophisticated town man sighs for the simple joys of the village, and this is a story which will appeal to them all. It is told with a soothing

charm and "Gruffy" the outcast of the town soon accommodates himself to his new environment and rules, not only his two masters, but the rest of the community, bipeds as well as quadrupeds, his slaves.

STEDMAN'S MEDICAL DICTIONARY. Edited by Norman Burke Taylor, M.D., F.R.S.C., F.R.C.S.(Edin.), F.R.C.P.(Canada), M.R.C.S.(Lond,), Pages xliv+1561, with 500 illustrations and 22 plates (six in colour). Eighteenth revised edition. London: Baillière, Tindall & Cox., Ltd. Price 63s. net.

THIS monumental tome is not so much a compilation of short treatises on various subjects as an exhaustive dictionary of words, with their derivations and pronunciations, appertaining to human medicine, dentistry, veterinary surgery and medicine, and related sciences. In addition, it contains anatomical tables and titles in general use; the new British anatomical nomenclature and that sanctioned by the Basle Anatomical Convention. Pharmaceutical preparations of the British and United States Pharmacopœiæ and those of the National Formulary are given, whilst biographical sketches of the principal figures in medical history, as well as many other interesting and useful items, are included.

A reliable dictionary is an indispensable possession to every intelligent person, and a dictionary of terms, etc., applicable to a person's especial calling is no less a necessity. This need is more than usually emphasised in the realm of medicine—be it concerned with man or the lower animals. "The necessity for new words is a healthy sign and, in a way, is a measure of progress . . . Words have been introduced very often with little regard for the rudimentary rules which should guide their creator. Etymological miscegenation has too frequently been practised with complacency, and has produced terms which . . . are hardly more than that of jargon. . . . Yet . . . the editor of a medical dictionary cannot be too much of a purist in the matter, and, except in the most extreme instances of bad word-forming, cannot deny them space. It seems desirable that some philological authority should be established (with the object) of giving approval to, or voicing disapproval of, a proposed new word, and an author in quest of a new term . . . could appeal to such a group of experts for assistance and advice."

These words from the preface will be endorsed by all who—from time to time—experience annoyance when endeavouring to elucidate the meaning of certain words and phrases encountered in some medical and veterinary literature. The need for a modern, comprehensive dictionary to save one from drawing possible erroneous conclusions is thus emphasised and, in any case, to permit of a fuller understanding of the subject matter.

The work is primarily intended for the medical profession, but the sciences of medicine which deal with man and "animals" are so closely allied, and the language of each is so similar, that its value to the veterinarian must be obvious. The fact that this book has reached its eighteenth edition is sufficient evidence of proven worth. Despite the undoubtedly high standard of this work, we feel that had the authors the advantage of a veterinary collaborator, its usefulness

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in the veterinary field would have been enhanced. Perusal at random has revealed the inclusion of such terms as curb, freemartin calves, lambing sickness, lamziekte, Newcastle disease, quittor, spavin and thoroughpin.

The work is well bound, attractively and clearly printed on good paper, and is profusely illustrated in a manner which adds much to the value of the text.

We consider it excellent value for the price of three guineas, and recommend it, with confidence, to our readers, who will undoubtedly find its possession of material assistance to them and realise the numerous occasions in the past when such a work would have saved them considerable time spent in consulting different works to elucidate problems.

MEMOIR

Florence Rena Sabin (1871-1953)

Florence Rena Sabin, whose death has recently been announced, was an Emeritus Member of the Rockefeller Institute for Medical Research, New York. Prior to her appointment to the Institute, she was, for a number of years, Professor of Histology in the Johns Hopkins University, Baltimore. It is primarily as an embryologist that she was known and will be remembered in the scientific world.

She was born on November 9, 1871, at Central City, Colo. She qualified in medicine but decided to devote herself entirely to academic science. She belonged to the generation of students who witnessed the great advance of anatomical studies in America, particularly in Baltimore under the influence of Franklin P. Mall. He came to America from the laboratory of Wilhelm His, that *clarum et venerable nomen* in embryology. Under Mall's guidance, Baltimore became a great centre for embryological studies, a tradition which is maintained up to this date by his successors like Streeter and Corner.

The influence of Mall is manifest throughout the works of Sabin. Anatomy, it is true, was learnt and taught for many centuries since the days of Galen, but, far from being a dead science, a new horizon was opened to it, during the late 19th century, by inaugurating researches in embryology. The investigation of the origin of organs will be the task for the future histologists, observed Mathias Duval. With the sole exception of "An Atlas of the Medulla and Midbrain" (1901), Sabin's work was devoted to further the development of this new science.

Sabin's position as an embryologist was secured by her important study on the origin of the lymphatic system. Although the development of lymphatic ganglia was known as early as 1897 thanks to the work of Ranvier, the investigations of Sabin stimulated a new interest and served a basis for our knowledge of this difficult problem more particularly in Mammals.

By far her best contribution to science was the study, undertaken between 1920-21, on the origin of blood vessels and of the red blood corpuscles. She inaugurated independently of Vera Danchakoff and Maximow, the embryo-

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logical studies of individual blood cells. Space does not permit me to discuss the relative importance of the opinions of Danchakoff, Maximow and Schridde. Suffice it to say that Sabin was the first embryologist who actually saw the differentiation of red cells from early endothelium in the living chick blastoderm.

Sabin was a pupil of Mall and remained throughout her life faithful to his tradition. Her biography on Mall bears testimony to this. Kind, she was ever ready to help those who sought her guidance. With her disappears one of the outstanding scientists America has produced.

NEWS

MR. NEIL MATHIESON, M.R.C.V.S., head of Glaxo's Veterinary Department, recently left London on a business trip to Australia and New Zealand. He will be away for about three months.

GLAXO LABORATORIES LTD. announce the introduction from February 8 of a new strength Veterinary Cytamen (crystalline vitamin B_{12}) containing 250 micrograms vitamin B_{12} per c.c. Veterinary Cytamen "250" will be available in 10 c.c. rubber-capped bottles.

GLAXO LABORATORIES, LTD., announce the introduction of Procaine Penicillin G Veterinary Cerate containing 300,000 units procaine penicillin G per tube. This new strength cerate is of special value in the treatment of animals on outlying farms as it provides adequate therapeutic penicillin levels for at least six or seven days. It is supplied in boxes of 12 single dose tubes.

THE DISTILLERS COMPANY (BIOCHEMICALS), LTD., announce the availability of a 30 ml. silicone-treated vial of "Distaquaine" Suspension (veterinary) as from March 1. The vials are packed singly and retail at 29s.

NOTICE

TRAINING OF BIOLOGISTS

THE Institute of Biology is arranging a meeting, to be held on April 21-22, to discuss the training of biologists. There will be four sessions: on the teaching of biology in schools; on undergraduate courses at universities; on biological work in technical colleges; and on postgraduate training. It is hoped that the meeting will attract teachers from schools, technical colleges and universities and representatives of employing bodies. Ample time will be allowed for discussion after the invited papers. A programme will be available early in March from the General Secretary, Institute of Biology, Tavistock House South, Tavistock Square, London, W.C.1.